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J 3309

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Fourth Semester

Mechanical Engineering

ME 1252 — KINEMATICS OF MACHINERY

(Regulation 2004)

(Common to B.E. (Part-Time) Third Semester – Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

Sketches should be drawn neatly.

Give brief procedure for graphical constructions.

Answer without units and with wrong units will carry less marks.

Symbols used in the solutions should be explained atleast once for each answer.

Answers without substituting the data in the equations will carry zero marks.

A3 size drawing sheet will be supplied on request. Use both sides of the drawing sheet, if necessary.

Fold the drawing sheet to the size of the answer sheet and attach it.

PART A — (10 × 2 = 20 marks)

1. Give any two inversions of a single slider chain.
2. Write Grashoff's law for 4-bar mechanism.
3. Draw an acceleration polygon for a crank rotating at an angular speed of ' ω ' rad/sec and angular acceleration of ' α ' rad/sec².
4. Explain how the direction of Coriolis acceleration is obtained.
5. What is the significance of pressure angle in cam?
6. What is the follower motion used for high speed cams? Why?
7. What are the advantages and dis-advantages of involute gear tooth profile?
8. What are the applications of inverted gear trains?

9. What is the apparent co-efficient of friction in belt drives?
 10. Distinguish between sliding and rolling friction.

PART B — (5 × 16 = 80 marks)

11. (a) Explain the working a quick return motion mechanism. Also derive an equation for the ratio of time taken for return stroke and forward strokes.

Or

- (b) Explain the working of a toggle mechanism and its application with a neat sketch.
 12. (a) A slider crank mechanism has a crank of 30 mm length and connecting rod 50 mm length. The angular velocity of crank is 10 rad/sec(ccw). The angular acceleration of the crank is 1200 rad/sec². The crank makes an angle of 90° with the line of strike. Determine the acceleration of slider and angular acceleration of connecting rod.

Or

- (b) The driving crank AB of a quick-return mechanism shown below revolves at a uniform speed of 200 rpm. Find the velocity of the tool-box R, in the position shown in Fig.1, when the crank makes as angle of 60° with the vertical line AP. Also determine the angular velocity of link PQ.

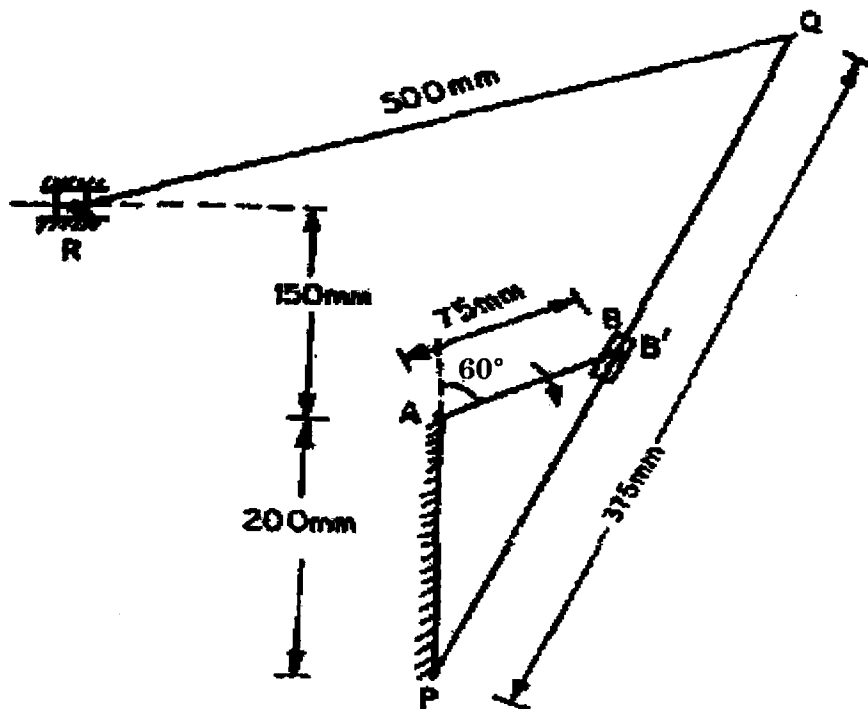


Fig. 1

13. (a) A cam is to be designed for a knife edge follower with the following data : cam lift = 40 mm during 90° of cam rotation with SHM, dwell for the next 30° , during the next 60° of cam rotation, the follower returns to its original position with SHM, dwell during the remaining 180° . Draw the profile of the cam when the line of stroke is offset 20 mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

Or

- (b) Draw a cam profile for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation. The valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam.
14. (a) A pinion of 20 involute teeth and 125 mm pitch circle diameter drives a rack. The addendum of both pinion and rack is 6.25 mm. What is the least pressure angle which can be used to avoid interference? With this pressure angle, find the length of the arc of contact and the minimum number of teeth in contact at a time.

Or

- (b) In an epicyclic gear train shown in Fig.2, the pinion A has 15 teeth and is rigidly fixed in the motor shaft. The wheel B has 20 teeth and gears with A, and also with annular fixed wheel D. Pinion C has 15 teeth and is integral with B (C, B being a compound gear wheel). Gear C meshes with annular wheel E, which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed and carries the compound wheel B-C. If the motor runs at 1000 rpm, find the speed of the machine shaft.

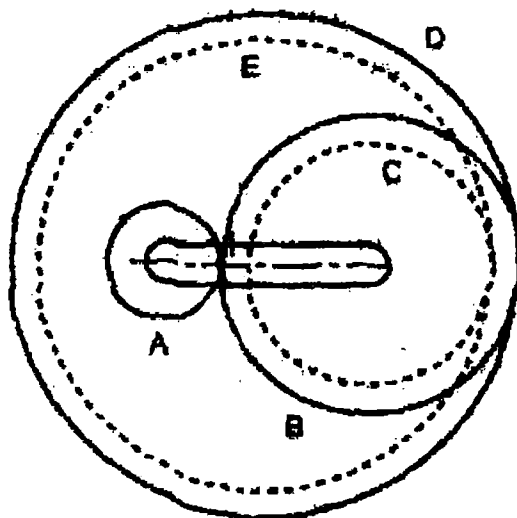


Fig. 2.

15. (a) A single dry plate clutch transmits 7.5 kW at 900 rpm. The axial pressure is limited to 0.07 N/mm^2 . If the co-efficient of friction is 0.25, find mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4 and outer and inner radii of the clutch plate.

Or

- (b) A load of 10 kN is raised by means of a screw jack, having a square threaded screw of 12 mm pitch and of mean diameter 50 mm. If a force of 100 N is applied at the end of a lever to raise the load, what should be the length of the lever used? Co-efficient of friction = 0.15. What is the mechanical advantage obtained? State whether the screw is self locking or not.